

Space Shuttle: Hubble Space Telescope servicing mission to be a challenge

The STS-109 mission of *Columbia* to service the Hubble Space Telescope is scheduled for launch no earlier than Feb. 28, 2002, at the Kennedy Space Center, Fla.

The mission is commanded by Scott Altman (Cmdr., USN) with Duane Carey (Lt. Col., USAF) serving as Pilot. Dr. John Grunsfeld will be Mission Specialist 1 and Payload Commander and Nancy Currie (Lt. Col., USA) is the Flight Engineer and Mission Specialist 2. Dr. Rick Linnehan is Mission Specialist 3, Dr. Jim Newman will serve as Mission Specialist 4 and Dr. Mike Massimino will be Mission Specialist 5.

On STS-109, the Hubble Space Telescope will be serviced for the fourth time since it was launched, as Grunsfeld and Linnehan team up to conduct three spacewalks and Newman and Massimino are paired for two spacewalks to install new, more durable solar arrays, a large gyroscopic assembly to help point the telescope properly, a new telescope power control unit and a cooling system to restore the use of a key infrared camera and spectrometer instrument which has been dormant since 1999.

In addition, almost 12 years after Hubble was launched, the telescope's view of the universe will be dramatically improved with the addition of the newest scientific instrument – the Advanced Camera for Surveys (ACS). With up to four times the speed of previous instruments, this device will be able to survey a field of the cosmos twice as large as before with 10 times the resolution.

The new instrument's potential dwarfs the capability of the existing and complementary Wide Field Planetary Camera, which provided the world's astronomers with breathtaking views of the Eagle Nebula and the Hubble Deep Field in recent years. The ACS will replace the Faint Object Camera, the last of Hubble's original instruments and the last to require the corrective optics that were installed in Hubble during the first servicing mission in 1993. All of the current generation instruments have their own internal corrective mirrors.



Astronaut John M. Grunsfeld, STS-109 Payload Commander, uses virtual reality hardware at JSC to rehearse some of his duties on the upcoming STS-109 mission, NASA's fourth servicing visit to the Hubble Space Telescope (HST).

The new solar arrays, which are the third set of power-generating wings for Hubble in its history, will generate 20 percent more power at two-thirds the size of the current arrays, with a new rigidity and durability that will provide the telescope with enough power for the rest of its operational lifetime. Rather than rolling up, the arrays each fold in two sections, providing greater reliability than its predecessors.

One of four Reaction Wheel Assemblies will be replaced during the flight. This mechanism helps to maneuver the telescope into the proper orientation for scientific observations. Although the assembly has not failed, it is exhibiting erratic behavior. Only three of the four assemblies are required for science, but a new assembly will be installed to insure Hubble's capability for new discoveries in the years to come.

The new Power Control Unit is the heart of electrical production for Hubble's systems. This unit will collect energy from the new solar arrays and distribute that power to all key Hubble components. The original unit has been operating since Hubble's launch in 1990. With Hubble's mission of discovery now extended to 2010, the new power unit will enable Hubble to remain healthier and more productive.

Its replacement will be the most complex task of the mission, requiring the delicate disconnection and reconnection of 36 small and closely spaced electrical connectors by the spacewalking astronauts. For the first time in history, all of Hubble's systems will be completely shut down to accommodate the spacewalking upgrade effort, which should take seven hours or more to complete.

The spacewalks and specific tasks to upgrade Hubble's instruments are regarded as more intricate and challenging than astronauts have encountered in previous servicing missions.

The flight will be the 27th for *Columbia* and its first mission since undergoing major modifications after its last flight in 1999. ♦

For more details about the mission, please visit:
<http://sm3b.gsfc.nasa.gov/>

Behind the scenes with ... Bryan Austin, STS-109 Lead Flight Director

By Melissa Davis

Q Can you give any insight on the work being done on the Hubble?

A We have a fantastic team of people working on the preparations for this mission. The Hubble Space Telescope (HST) team at Goddard Space Flight Center (GSFC) is very experienced, having completed three previous servicing missions, as well as dealing with the day-to-day operations of the HST on orbit.

The objectives of Hubble Servicing Mission 3B are to improve Hubble's scientific productivity by greatly improving visible imaging capability, restoring infrared science capability and also to replace failed or degraded spacecraft components. Specifically, we are replacing the pair of solar arrays with new fix panel arrays, replacing a failing power control unit, installing a new Advanced Camera for Surveys, which is expected to increase scientific discovery by 10 times, and installing a cooling system to regain the operations of the Near Infrared Camera and Multi-Object Spectrometer science instrument.

Q What are some specific challenges you will face?

A Five EVAs (extravehicular activity, or spacewalks) are the most we have ever attempted in a single Shuttle mission. This HST servicing mission is shaping up to be the most challenging of any servicing mission. Each of the EVA tasks fills most of the EVA day with little margin to accommodate failures and still get everything accomplished.

Q What should readers keep in mind and be on the lookout for when following this particular mission?

A It may be difficult to recognize, but each of these EVAs are very tightly choreographed. Each EVA crewman will be doing something different, one on the RMS and one free-floating. Along with this, the flight control teams in JSC's Mission Control Center (MCC) and at GSFC's Space Telescope Operations Control Center (STOCC) are integrated into the activities to configure the HST in preparation for the EVA, verify subsequent safety statuses and then quickly test the new equipment to ensure it is working.

Q What interesting behind-the-scenes activity is going on with this mission that readers might be surprised to know?

A Because each EVA is so tightly choreographed, we have to watch the extravehicular mobility unit (EMU) suit consumables (oxygen, power, etc.) to determine how much longer we could stay out in the event we have a problem. The EVA flight controller is continually tracking the pace of the EVA and determining if the crew is ahead or behind and what we would do if we had to "breakout" of the EVA.

Another interesting item is the magnitude of ground team interaction and communications that goes on between the team in Houston and the HST team.

Q Would you like to add anything else?

A I have been fortunate to play a part in every HST mission. I was the Training Simulation Supervisor for STS-31 and STS-61. After being selected into the Flight Director Office, I was one of the Flight Directors for STS-82 and STS-103. It's a great privilege for me to be the Lead Flight Director for this mission.